

High-Definition Multimedia Interface

Version 2.0

Quantum Data MOI v1.0a

Test ID: HF1-53

December 8, 2015

Preface

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Document Revision History

1.0a December 8, 2015 – Updated Generic Procedure and updated reference Quantum Data required equipment.

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Contact Information

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Introduction

This document provides a set of Method of Implementation for test method described in HDMI Compliance Test Specification Version 2.0 (HDMI CTS 2.0). HDMI Forum created HDMI CTS 2.0 to specify a set of tests that should be performed to verify features described in HDMI Specification Version 2.0.

Scope

This document provides testing procedures for HDMI CTS 2.0 Test ID HF1-53: Source Dynamic Range and Mastering InfoFrame – High Dynamic Range.” The procedure below deals with single resolution and only one Test ID is considered at a time.

References

Normative References

High-Definition Multimedia Interface Specification Version 1.4b, October 11, 2011.
HDMI Compliance Test Specification Version 1.4b, October 11, 2011.
High-Definition Multimedia Interface Specification Version 2.0, August, 2013.
HDMI 2.0 Generic Compliance Test Specification Version 2.0b, January 2015.

Informative Reference

No additional informative references.

Test ID HF1-53: Source Dynamic Range and Mastering InfoFrame – High Dynamic Range

Objective

Confirm that the Source DUT sends the Dynamic Range and Mastering InfoFrame when it is sending HDR content.

Table 7-114 Source Dynamic Range and Mastering InfoFrame – High Dynamic Range

| Reference | Requirement |
|--|-----------------------------|
| [HDMI: 2.0: Appendix G.2] Dynamic Range and Mastering InfoFrame | <See reference for details> |

Capability(s)

The Source DUT supports any High Dynamic Range content transmission.

Test Equipment

| Item | Generic Equipment | Vendor Specific Equipment | Quantity |
|------|----------------------------|--|----------|
| 1 | HDMI 2.0 Protocol Analyzer | 980 Advanced Test Platform series: 980 HDMI 2.0 Protocol Analyzer module HDMI CTS 2.0 Compliance Test Package #3 | 1 |

Generic Procedure

- 1 If all of the CDF fields Source_HDR_Traditional_SDR, Source_HDR_Traditional_HDR and Source_HDR_SMPTE_ST_2084 are “N”, then SKIP this test.

Setup:

- 2 Connect the Source DUT to the Protocol Analyzer.
- 3 If the CDF field Source_HDR_Traditional_SDR is “Y”, then
 - 3.1 Configure the EDID containing the following:

3.1.1 HDR Static Metadata Block with:

3.1.1.1 ET_0 = 1, ET_1 = 0, ET_2 = 0, ET_3 = 0, ET_4 = 0, ET_5 = 0,
SM_0 = 1, SM_1 = 0, SM_2 = 0, SM_3 = 0, SM_4 = 0, SM_5 = 0,
SM_6 = 0, SM_7 = 0.

Measure:

- 3.2 Operate the Source DUT to output any Traditional gamma-SDR Luminance Range content defined in CEA-861.3.
- 3.3 Capture the data (and descramble it if needed) and verify it as follows:

[Verify that at least one Dynamic Range and Mastering InfoFrame is transmitted for every two video fields]

- 3.4 If Dynamic Range and Mastering InfoFrame (HB0 (Packet Type) is equal to 0x87) does not occur at least once per two Video Fields, then FAIL.

[Verify that content of Dynamic Range and Mastering InfoFrame]

- 3.5 Check the Dynamic Range and Mastering InfoFrame as following:

- 3.5.1 If HB1 (Version) is not equal to 0x01, then FAIL.
- 3.5.2 If HB2 (Length) is not equal to 26, then FAIL.
- 3.5.3 If PB1 bit 7-3 is not equal to 0, then FAIL.
- 3.5.4 If PB1 bit 2-0 is not equal to 0, then FAIL.
- 3.5.5 If PB2 bit 7-3 is not equal to 0, then FAIL.
- 3.5.6 If PB2 bit 2-0 is not equal to 0, then FAIL.
- 3.5.7 If PB4-PB3 is more than 0xC350, then FAIL.
- 3.5.8 If PB6-PB5 is more than 0xC350, then FAIL.
- 3.5.9 If PB8-PB7 is more than 0xC350, then FAIL.
- 3.5.10 If PB10-PB9 is more than 0xC350, then FAIL.
- 3.5.11 If PB12-PB11 is more than 0xC350, then FAIL.
- 3.5.12 If PB14-PB13 is more than 0xC350, then FAIL.
- 3.5.13 If PB16-PB15 is more than 0xC350, then FAIL.
- 3.5.14 If PB18-PB17 is more than 0xC350, then FAIL.

[Verify that switch procedure of Dynamic Range and Mastering InfoFrame]

Measure:

- 3.6 Monitor consecutive video signals and InfoFrames from this step to 3.9.
- 3.7 Operate the Source DUT to switch to transmitting any SDR content which doesn't require the Dynamic Range and Mastering InfoFrame.
- 3.8 If the Source DUT maintains the video signal with no loss of sync and switches to the SDR content which doesn't require the Dynamic Range and Mastering InfoFrame, then check the following, else SKIP 3.9:

[Verify that Dynamic Range and Mastering InfoFrame is continuously transmitted for at least two seconds]

- 3.9 If the Source DUT does not output a Dynamic Range and Mastering InfoFrame (HB0 (Packet Type) is equal to 0x87) with EOTF field set to '0', the Static_Metadata_Descriptor_ID field set to '0', and the fields of the Static_Metadata_Descriptor (see CEA-861.3 table 5) set to unknown (0) for at least two seconds after the switching to the SDR content which doesn't require the Dynamic Range and Mastering InfoFrame, then FAIL.

- 4 If the CDF field Source_HDR_Traditional_HDR is "Y", then

Setup:

- 4.1 Configure the EDID containing the following:
 - 4.1.1 HDR Static Metadata Block with:
 - 4.1.2 ET_0 = 1, ET_1 = 1, ET_2 = 0, ET_3 = 0, ET_4 = 0, ET_5 = 0,
SM_0 = 1, SM_1 = 0, SM_2 = 0, SM_3 = 0, SM_4 = 0, SM_5 = 0, SM_6 = 0,
SM_7 = 0.

Measure:

- 4.2 Operate the Source DUT to output any Traditional gamma-HDR Luminance Range content defined in CEA-861.3.
- 4.3 Capture the data (descramble if needed) and verify as follows:

[Verify that at least one Dynamic Range and Mastering InfoFrame is transmitted for every two video fields]

- 4.4 If Dynamic Range and Mastering InfoFrame (HB0 (Packet Type) is equal to 0x87) does not occur at least once per two Video Fields, then FAIL.

[Verify that content of Dynamic Range and Mastering InfoFrame]

- 4.5 Check the Dynamic Range and Mastering InfoFrame as following:
 - 4.5.1 If HB1 (Version) is not equal to 0x01, then FAIL.
 - 4.5.2 If HB2 (Length) is not equal to 26, then FAIL.
 - 4.5.3 If PB1 bit 7-3 is not equal to 0, then FAIL.
 - 4.5.4 If PB1 bit 2-0 is not equal to 1, then FAIL.
 - 4.5.5 If PB2 bit 7-3 is not equal to 0, then FAIL.
 - 4.5.6 If PB2 bit 2-0 is not equal to 0, then FAIL.
 - 4.5.7 If PB4-PB3 is more than 0xC350, then FAIL.

- 4.5.8 If PB6-PB5 is more than 0xC350, then FAIL.
- 4.5.9 If PB8-PB7 is more than 0xC350, then FAIL.
- 4.5.10 If PB10-PB9 is more than 0xC350, then FAIL.
- 4.5.11 If PB12-PB11 is more than 0xC350, then FAIL.
- 4.5.12 If PB14-PB13 is more than 0xC350, then FAIL.
- 4.5.13 If PB16-PB15 is more than 0xC350, then FAIL.
- 4.5.14 If PB18-PB17 is more than 0xC350, then FAIL.

[Verify that switch procedure of Dynamic Range and Mastering InfoFrame]

Measure:

- 4.6 Monitor consecutive video signals and InfoFrames from this step to 4.9.
- 4.7 Operate the Source DUT to switch to transmitting any SDR content which doesn't require the Dynamic Range and Mastering InfoFrame.
- 4.8 If the Source DUT maintains the video signal with no loss of sync and switches to the SDR content which doesn't require the Dynamic Range and Mastering InfoFrame, then check the following, else SKIP 4.9:

[Verify that Dynamic Range and Mastering InfoFrame is continuously transmitted for at least two seconds]

- 4.9 If the Source DUT does not output a Dynamic Range and Mastering InfoFrame (HB0 (Packet Type) is equal to 0x87) with EOTF field set to '0', the Static_Metadata_Descriptor_ID field set to '0', and the fields of the Static_Metadata_Descriptor (see CEA-861.3 table 5) set to unknown (0) for at least two seconds after the switching to the SDR content which doesn't require the Dynamic Range and Mastering InfoFrame, then FAIL.

- 5 If the CDF field Source_HDR_SMPTE_ST_2084 is "Y", then

Setup:

- 5.1 Configure the EDID containing the following:
 - 5.1.1 HDR Static Metadata Block with:
 - 5.1.2 ET_0 = 1, ET_1 = 0, ET_2 = 1, ET_3 = 0, ET_4 = 0, ET_5 = 0,
SM_0 = 1, SM_1 = 0, SM_2 = 0, SM_3 = 0, SM_4 = 0, SM_5 = 0, SM_6 = 0,
SM_7 = 0.

Measure:

5.2 Operate the Source DUT to output any SMPTE ST 2084 content defined in CEA-861.3.

5.3 Capture the data (descramble if needed) and verify as follows:

[Verify that at least one Dynamic Range and Mastering InfoFrame is transmitted for every two video fields]

5.4 If Dynamic Range and Mastering InfoFrame (HB0 (Packet Type) is equal to 0x87) does not occur at least once per two Video Fields, then FAIL.

[Verify that content of Dynamic Range and Mastering InfoFrame]

5.5 Check the Dynamic Range and Mastering InfoFrame as following:

5.5.1 If HB1 (Version) is not equal to 0x01, then FAIL.

5.5.2 If HB2 (Length) is not equal to 26, then FAIL.

5.5.3 If PB1 bit 7-3 is not equal to 0, then FAIL.

5.5.4 If PB1 bit 2-0 is not equal to 2, then FAIL.

5.5.5 If PB2 bit 7-3 is not equal to 0, then FAIL.

5.5.6 If PB2 bit 2-0 is not equal to 0, then FAIL.

5.5.7 If PB4-PB3 is more than 0xC350, then FAIL.

5.5.8 If PB6-PB5 is more than 0xC350, then FAIL.

5.5.9 If PB8-PB7 is more than 0xC350, then FAIL.

5.5.10 If PB10-PB9 is more than 0xC350, then FAIL.

5.5.11 If PB12-PB11 is more than 0xC350, then FAIL.

5.5.12 If PB14-PB13 is more than 0xC350, then FAIL.

5.5.13 If PB16-PB15 is more than 0xC350, then FAIL.

5.5.14 If PB18-PB17 is more than 0xC350, then FAIL.

[Verify that switch procedure of Dynamic Range and Mastering InfoFrame]

Measure:

5.6 Monitor consecutive video signals and InfoFrames from this step to 5.9.

5.7 Operate the Source DUT to switch to transmitting any SDR content which doesn't require the Dynamic Range and Mastering InfoFrame.

- 5.8 If the Source DUT maintains the video signal with no loss of sync and switches to the SDR content which doesn't require the Dynamic Range and Mastering InfoFrame, then check the following, else SKIP 5.9:

[Verify that Dynamic Range and Mastering InfoFrame is continuously transmitted for at least two seconds]

- 5.9 If the Source DUT does not output a Dynamic Range and Mastering InfoFrame (HBO (Packet Type) is equal to 0x87) with EOTF field set to '0', the Static_Metadata_Descriptor_ID field set to '0', and the fields of the Static_Metadata_Descriptor (see CEA-861.3 table 5) set to unknown (0) for at least two seconds after the switching to the SDR content which doesn't require the Dynamic Range and Mastering InfoFrame, then FAIL.

- 6 If the CDF field Source_HDR_Traditional_HDR is "Y", then,

Setup:

- 6.1 Configure the EDID containing the following:

6.1.1 HDR Static Metadata Block with:

6.1.1.1 ET_0 = 1, ET_1 = 0, ET_2 = 1, ET_3 = 0, ET_4 = 0, ET_5 = 0,
SM_0 = 1, SM_1 = 0, SM_2 = 0, SM_3 = 0, SM_4 = 0, SM_5 = 0,
SM_6 = 0, SM_7 = 0.

Measure:

- 6.2 Operate the Source DUT to output any Traditional gamma-HDR Luminance Range content defined in CEA-861.3.
- 6.3 Capture the data (descramble if needed) and verify as follows:
- 6.3.1 If any Dynamic Range and Mastering InfoFrame with its EOTF field value of 1 occurs, then FAIL.

- 7 If the CDF field Source_HDR_SMPTE_ST_2084 is "Y", then,

Setup:

- 7.1 Configure the EDID containing the following:

7.1.1 HDR Static Metadata Block with:

7.1.1.1 ET_0 = 1, ET_1 = 1, ET_2 = 0, ET_3 = 0, ET_4 = 0, ET_5 = 0,
SM_0 = 1, SM_1 = 0, SM_2 = 0, SM_3 = 0, SM_4 = 0, SM_5 = 0,
SM_6 = 0, SM_7 = 0.

Measure:

- 7.2 Operate the Source DUT to output any SMPTE ST 2084 content defined in CEA-861.3.

7.3 Capture the data (descramble if needed) and verify as follows:

7.3.1 If any Dynamic Range and Mastering InfoFrame with its EOTF field value of 2 occurs, then FAIL.

Vendor Specific Test Procedure

Test Equipment

A variety of equipment is needed for testing HDMI products. Each piece is authorized and included by name in this Compliance Test Specification. This section describes the Quantum Data test equipment.

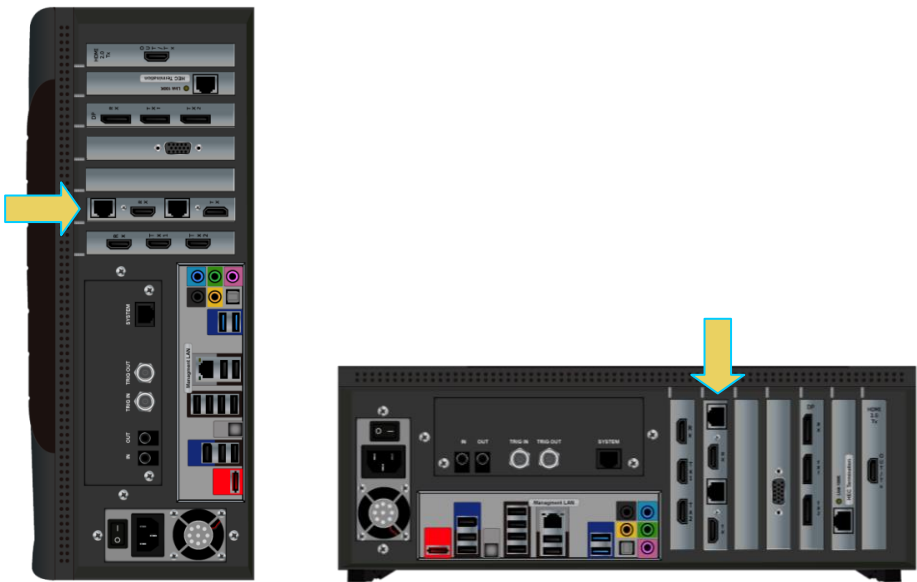
HDMI 2.0 Protocol Analyzer module

The Quantum Data 980 HDMI 1.4 Protocol Analyzer module can be installed in the 980B or 980R series Advanced Test Platforms. This 980 HDMI 1.4 Protocol Analyzer module serves the generic test functions called out in the HDMI 2.0 Generic CTS. Refer to the table below:

| Item | Quantum Data Equipment | |
|------|------------------------------------|---|
| 1 | 980 Advanced Test Platform series: | |
| | Equipped with: | 980 HDMI 1.4 Protocol Analyzer module |
| | | HDMI CTS 2.0 Compliance Test Package #1 or #3 |

980 HDMI 1.4 Protocol Analyzer Module with 980 Series Platform Configurations

The figures below show depictions of the 980 HDMI 1.4 Protocol Analyzer module equipped in various 980 series platforms. **Note:** Card positioning may vary depending on configuration.



Source Dynamic Range and Mastering InfoFrame – High Dynamic Range

Test ID HF1-53: Source Dynamic Range and Mastering InfoFrame – High Dynamic Range

1. Objective

Confirm that the Source DUT sends the Dynamic Range and Mastering InfoFrame when it is sending HDR content.

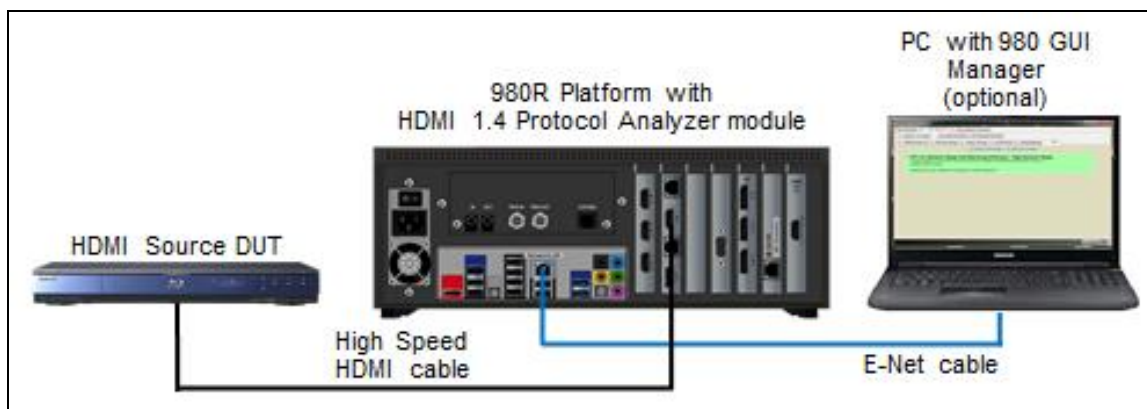
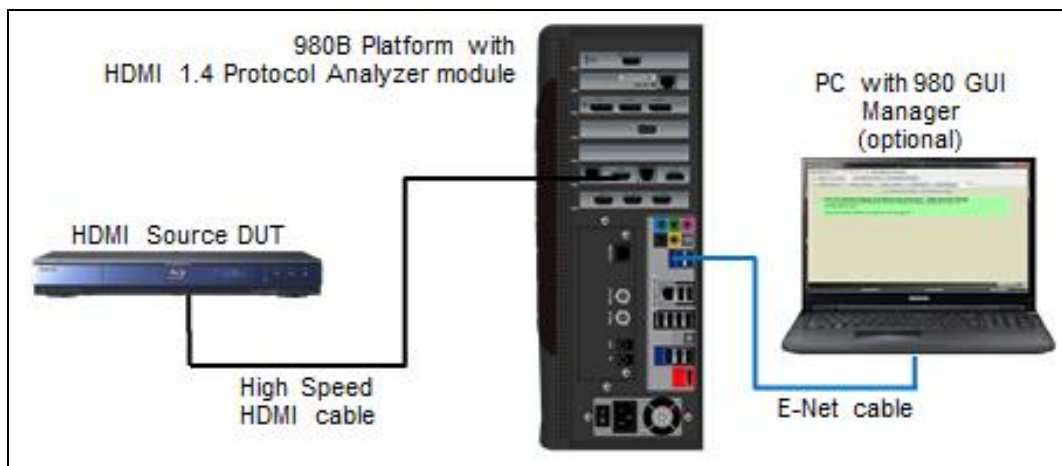
2. Test Overview

The Pass/Fail criteria is assessed by the application with no human examination required.

3. Procedure

Use the following procedure to conduct this test.

- 1 Connect Source DUT to the Quantum Data 980 HDMI 1.4 Protocol Analyzer at the module's port labeled Rx. Use a High Speed HDMI cable. The figures below show depictions of connections to the 980 HDMI 1.4 Protocol Analyzer module residing in the 980 series chassis.



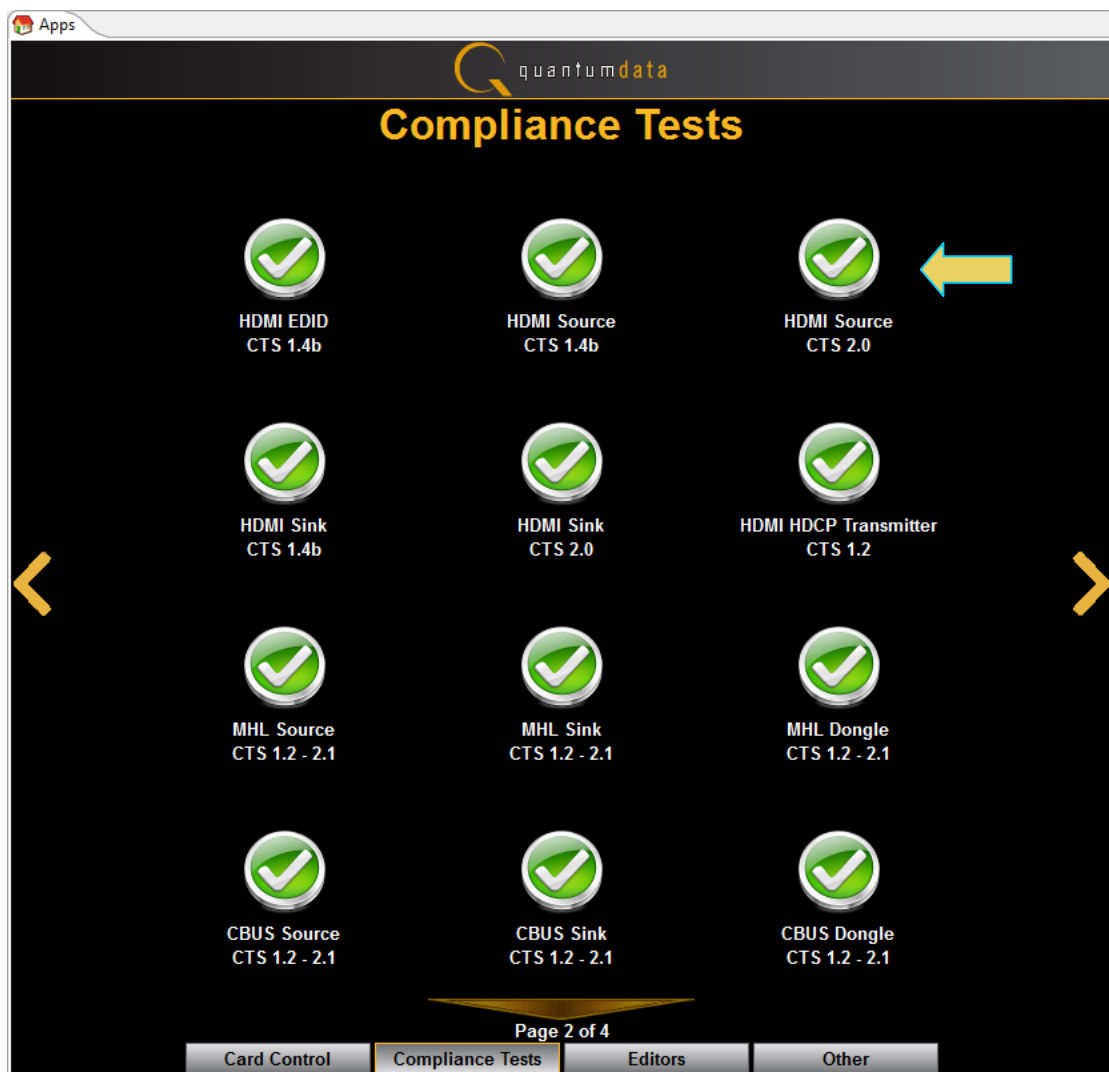
- 2 Operate the Source DUT to output the supported format and content.

- 3 Use Quantum Data 980 Embedded Manager GUI (touchscreen) or invoke Quantum Data 980 External Manager GUI (Windows application).

Note: You will not need to connect the PC shown in the figures above if you are running the compliance test through the 980's embedded display. The PC running the 980 HDMI 1.4 Protocol Analyzer module's compliance test application is connected to the 980 through a standard Ethernet cable.

- 4 Complete the following steps:

- 4.1 Click on the HDMI Source CTS 2.0 icon in the Compliance Tests page of the Apps panel.



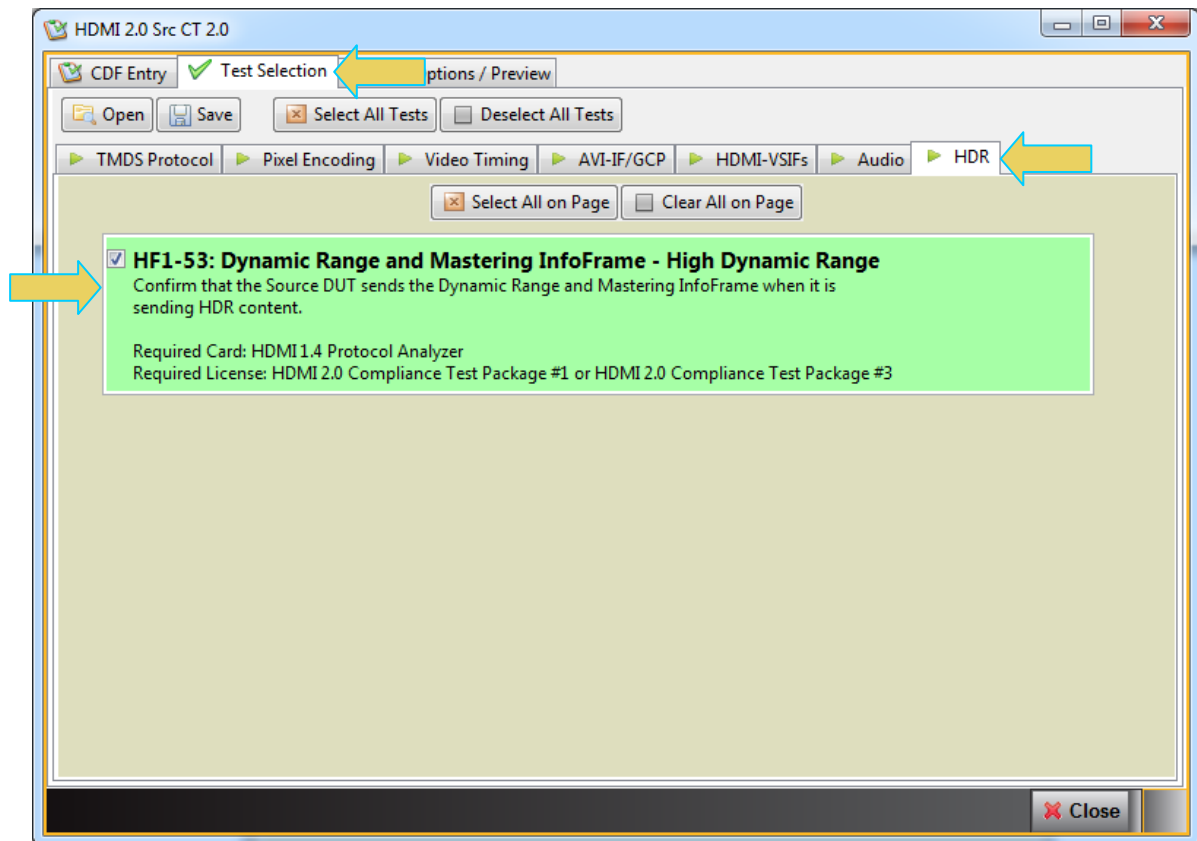
- 4.2 Navigate to the CDF tab if not already there. If there is a saved CDF file, then click on Open and select it. Otherwise, enter the DUT's CDF information for each tab and optionally click on Save to save the CDF. Select the items on the HDR tab in accordance with the DUT capabilities.

The screenshot shows the 'HDMI 2.0 Src CT 2.0' application window. The 'CDF Entry' tab is active, and the 'HDR' sub-tab is selected, indicated by a yellow arrow. The interface includes a menu bar with 'Open', 'New', and 'Save' options, and a status bar showing 'CDF File: <not saved>'. Below the menu bar, there are several tabs: 'General', 'Y420 Video', '21:9 (64:27) Video', '6G Video', 'non2160p Timings', 'Read Request', and 'HDR'. The 'HDR' tab contains four questions with radio button answers:

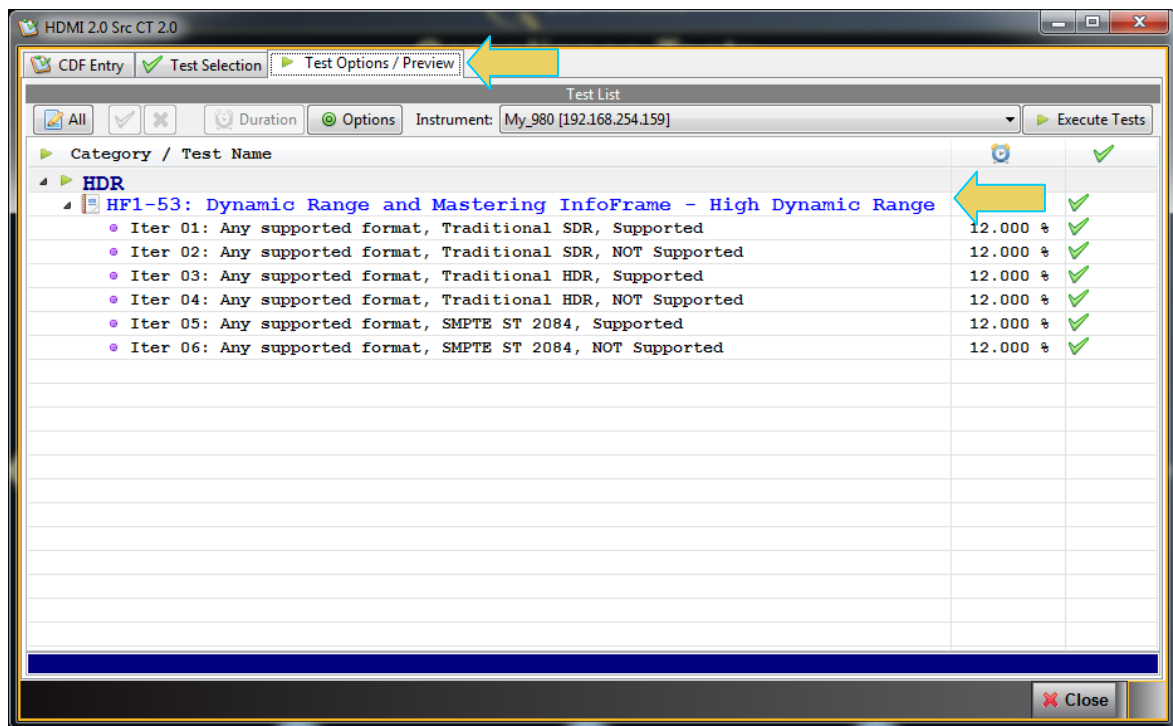
| Source_HDR | Does the product support any High Dynamic Range Video? |
|----------------------------|--|
| Source_HDR | <input checked="" type="radio"/> Yes <input type="radio"/> No |
| Source_HDR_Traditional_SDR | Does the product support Traditional Gamma SDR Luminance Range of High Dynamic Range Video? <input checked="" type="radio"/> Yes <input type="radio"/> No |
| Source_HDR_Traditional_HDR | Does the product support Traditional Gamma HDR Luminance Range of High Dynamic Range Video? <input checked="" type="radio"/> Yes <input type="radio"/> No |
| Source_HDR_SMPTE_ST_2084 | Does the product support SMPTE ST 2084 of High Dynamic Range Video? <input checked="" type="radio"/> Yes <input type="radio"/> No |

A yellow arrow points to the 'Source_HDR' label, and another yellow arrow points to the 'HDR' tab. A 'Close' button is located at the bottom right of the window.

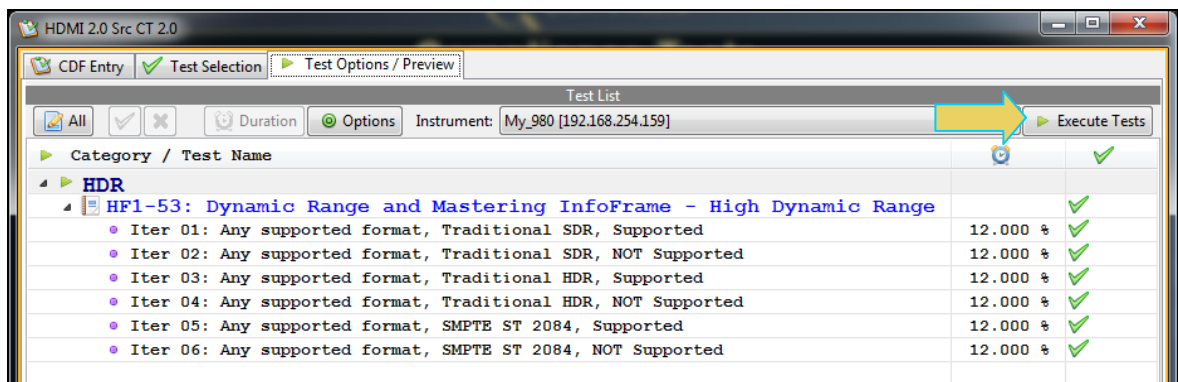
- 4.3 Click on the Test Selection tab and the Video Timing sub tab and select the Test ID HF1-53: Source Dynamic Range and Mastering InfoFrame – High Dynamic Range Test. Refer to the sample screen below.



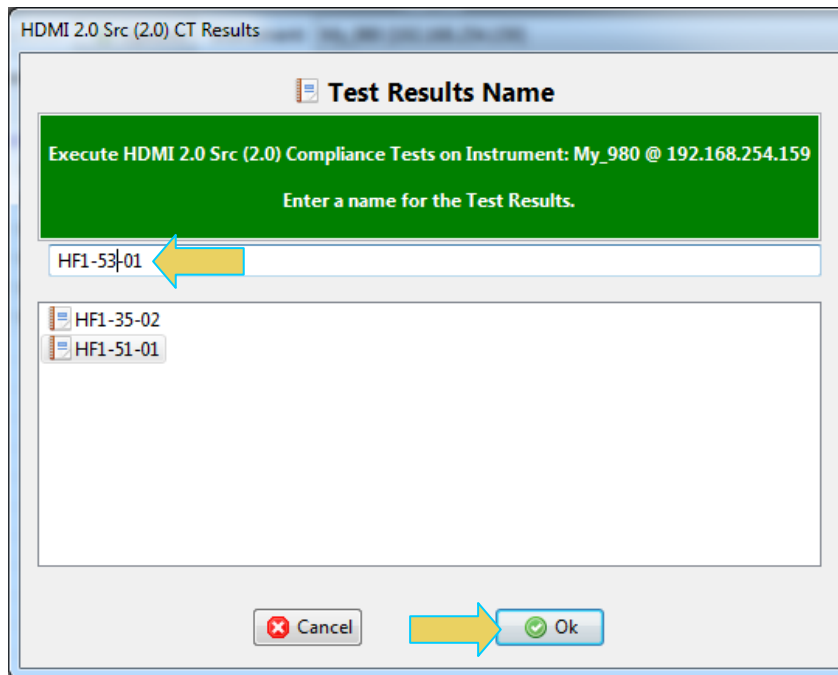
- 4.4 Click on Test Options / Preview tab and review the list of tests. Refer to the sample screen below.



4.5 Click on Execute tests activation button to initiate the test. Refer to the sample screen below.

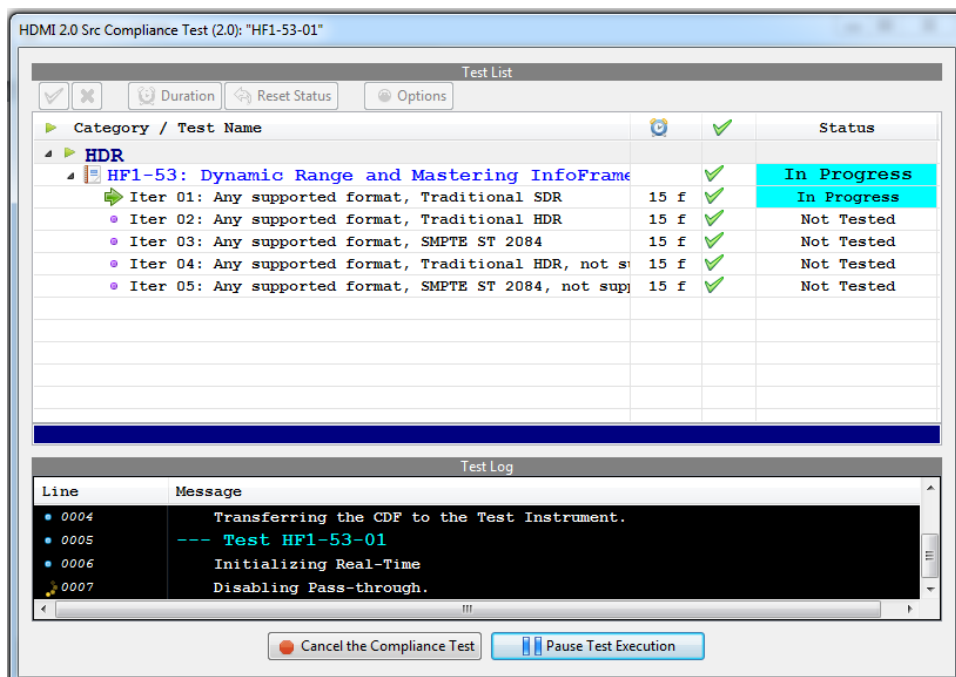


Note: You will be prompted with a dialog box to assign a name to the test results. Refer to the screen example below:

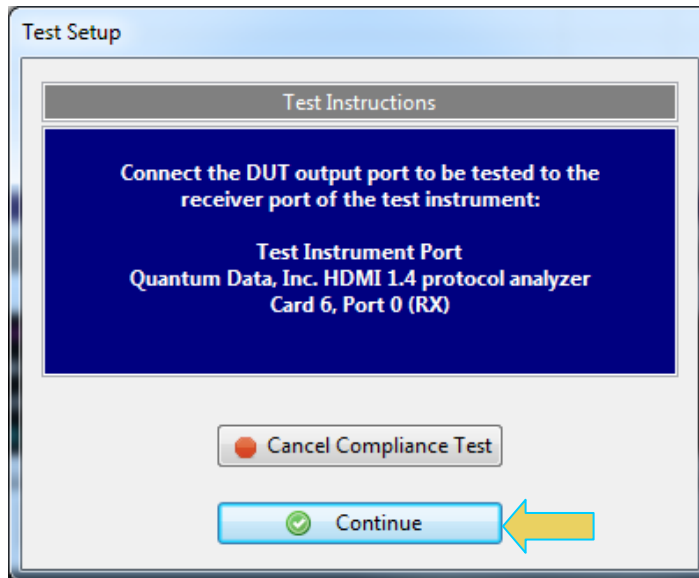


Enter a name, click OK and the test will begin.

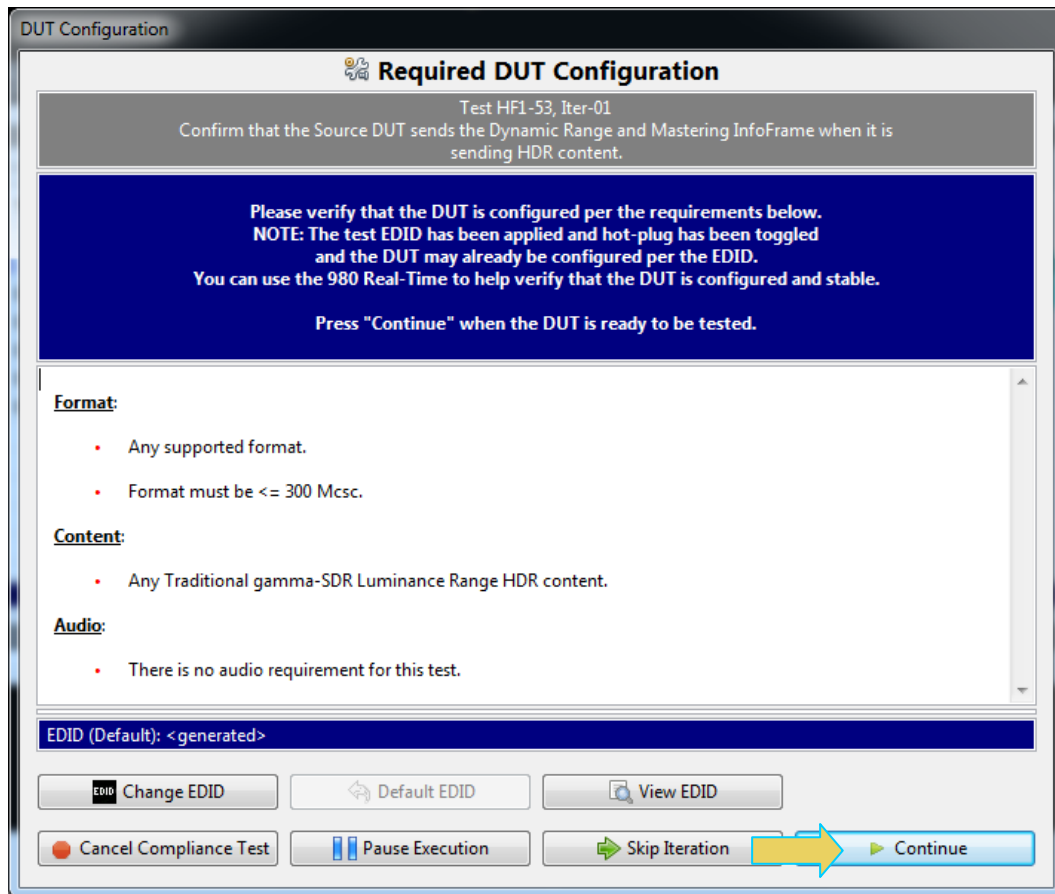
A Test Window will appear (below) indicating the progress of the test.



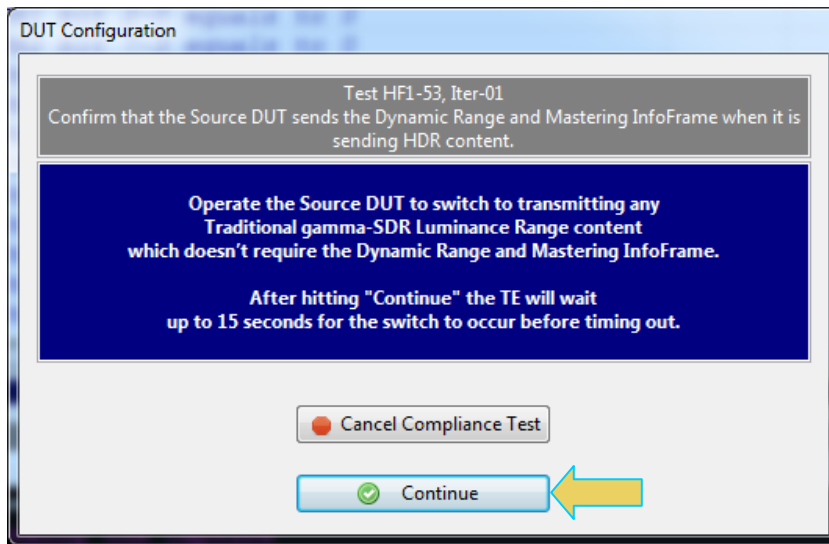
- 5 You will be prompted with a dialog box (below) instructing you to connect the DUT to the test equipment. Press Continue to run the test when the proper connection is made.



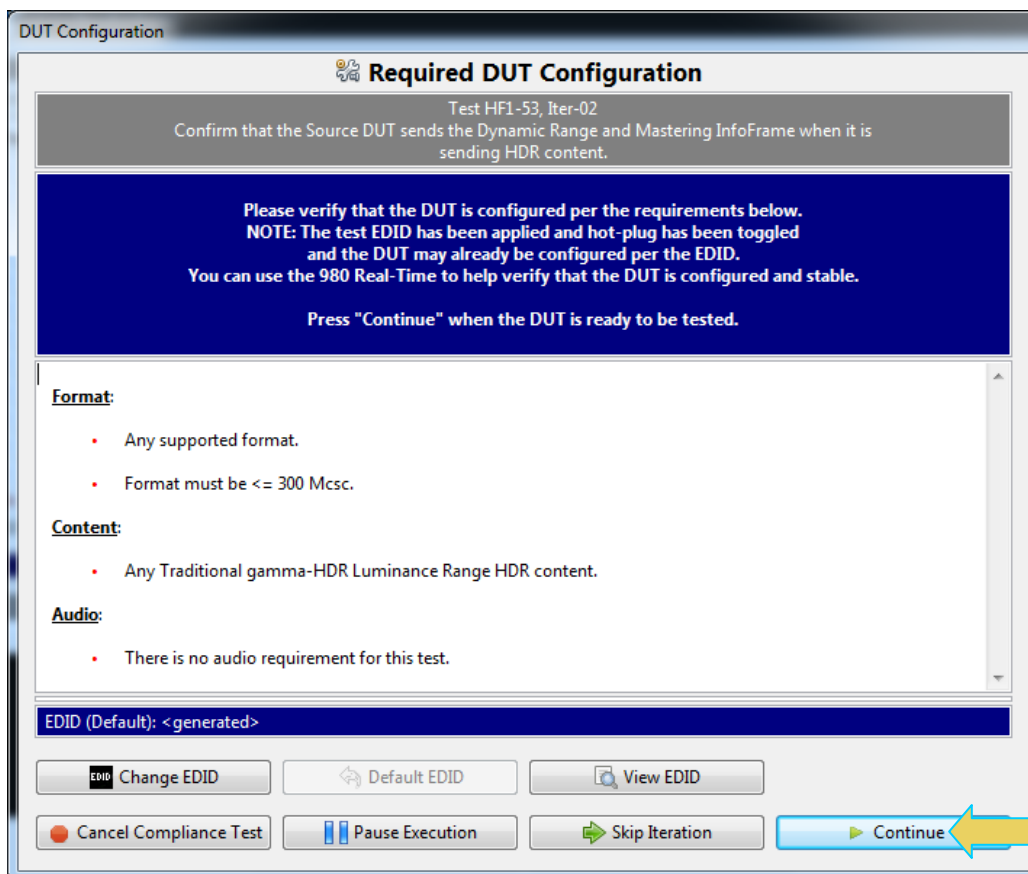
- 6 You will then be prompted with a series of dialog boxes informing you of the requirements of the source DUT for each distinct sub test. Verify that the source is outputting the required HDMI content and press Continue to run the test.



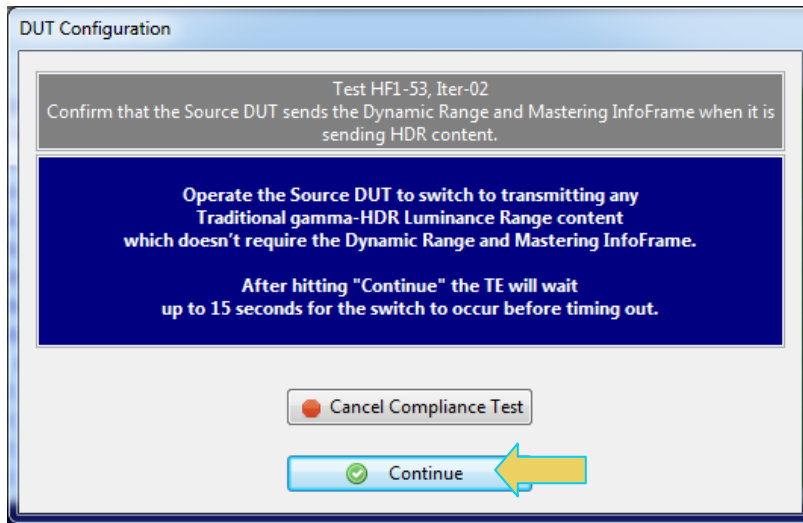
A DUT Configuration dialog box will appear (below). Follow the instructions on the dialog box and press Continue when the DUT is ready for the test.



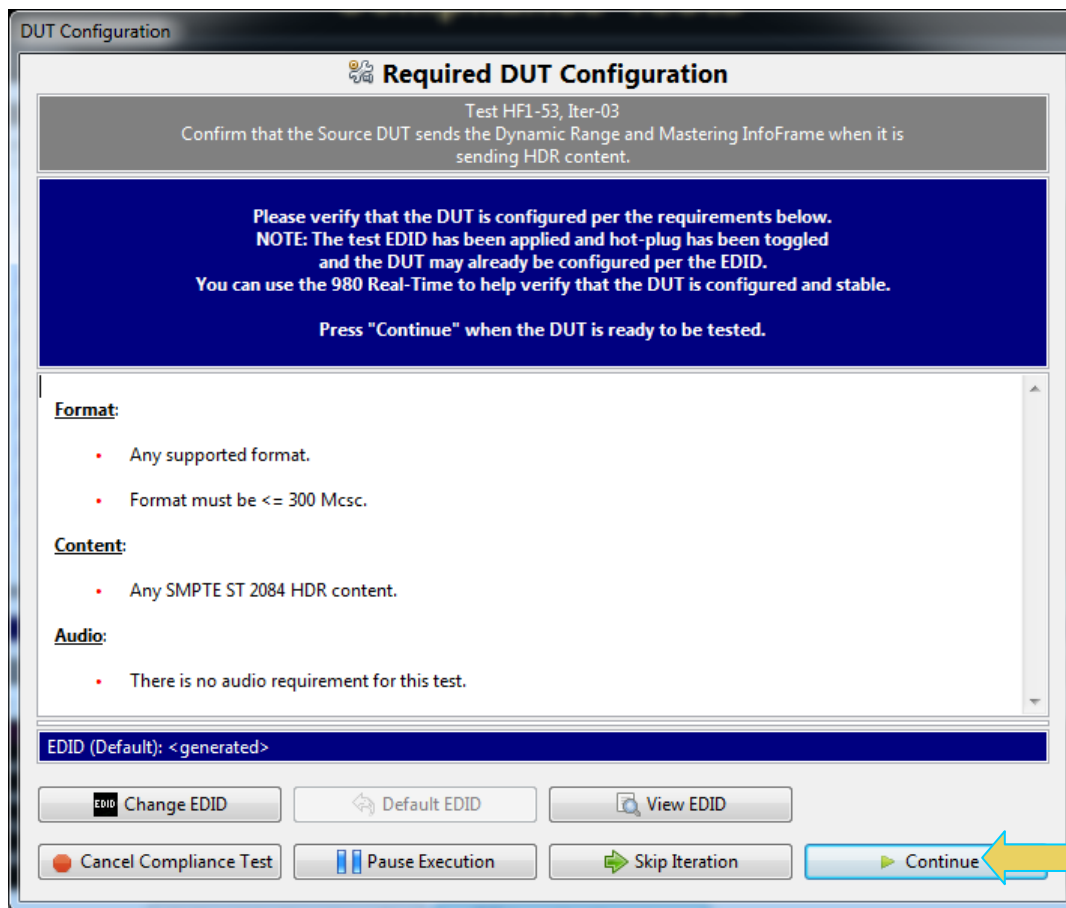
- 7 Another DUT Configuration dialog box will appear instructing you to configure the DUT to output a specific HDR content. Press Continue when the DUT is outputting the proper content.



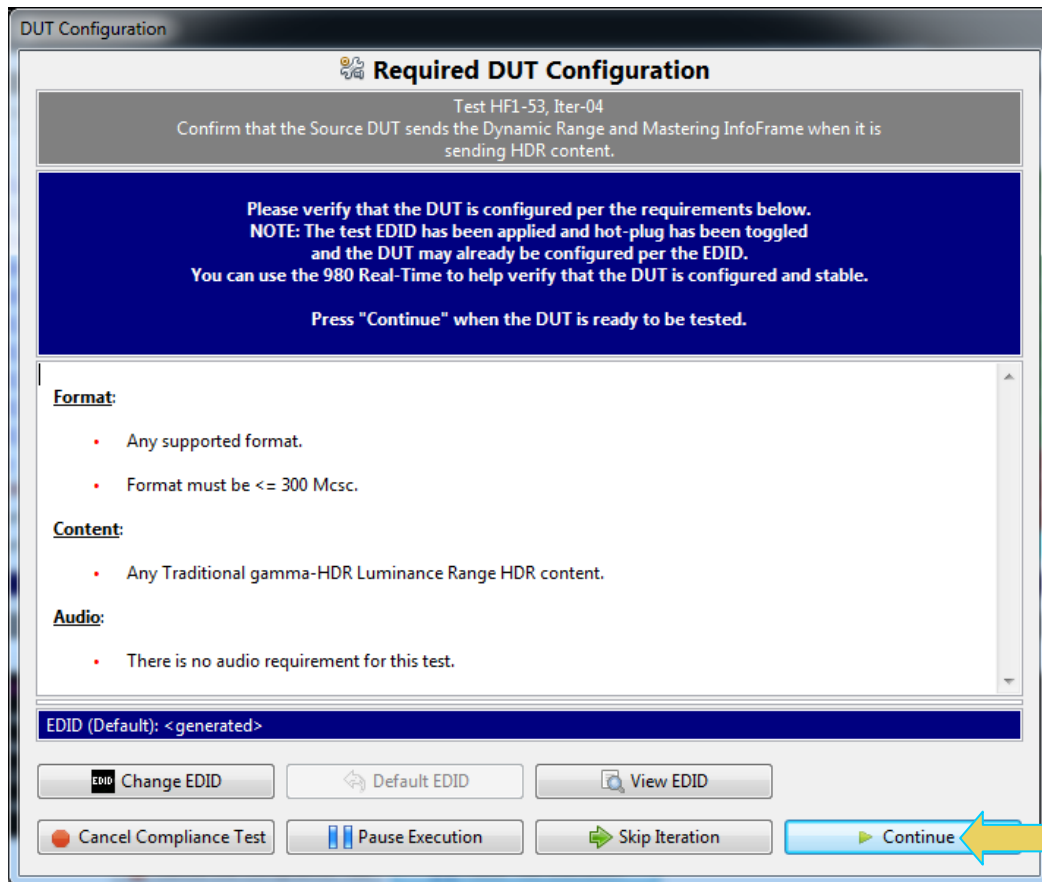
Another DUT Configuration dialog box will appear (below). Follow the instructions on the dialog box and press Continue when the DUT is ready for the test.



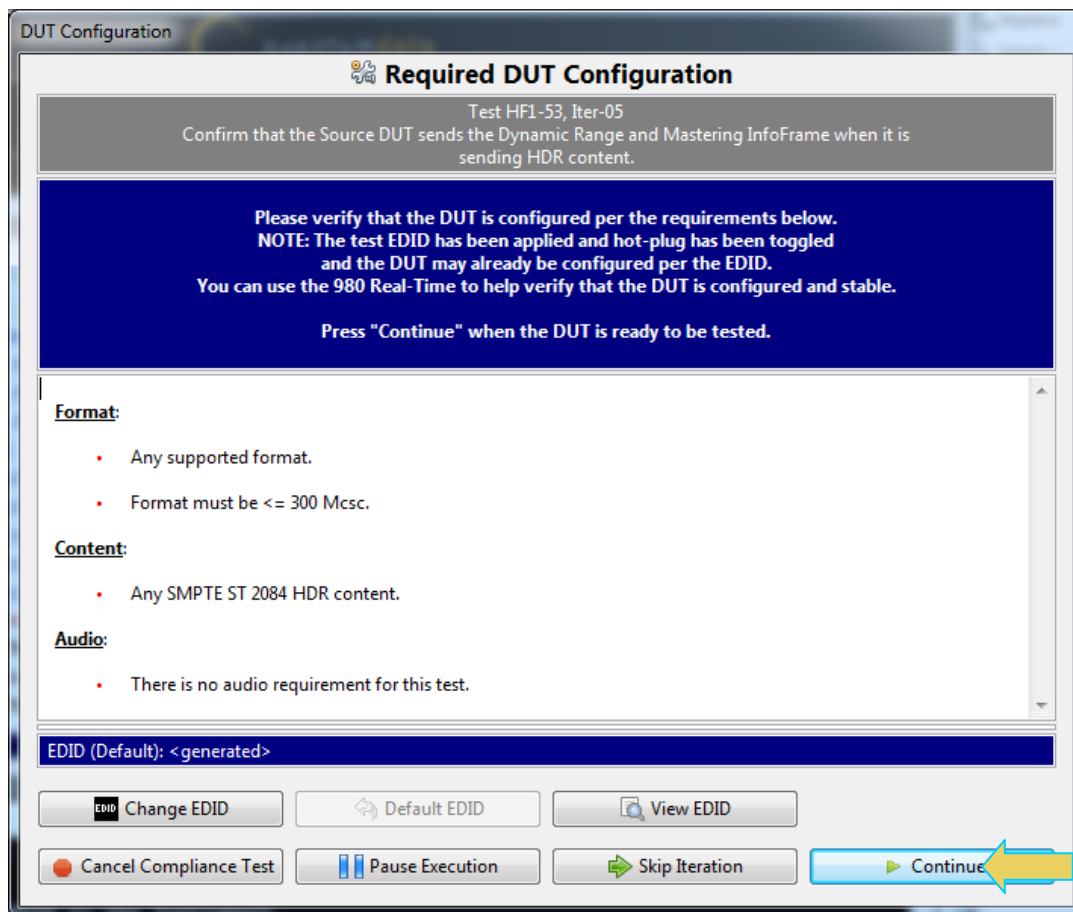
- 8 Another DUT Configuration dialog box will appear instructing you to configure the DUT to output a specific HDR content. Press Continue when the DUT is outputting the proper content.



- 9 Another DUT Configuration dialog box will appear instructing you to configure the DUT to output a specific HDR content. Press Continue when the DUT is outputting the proper content.



- 10 Another DUT Configuration dialog box will appear instructing you to configure the DUT to output a specific HDR content. Press Continue when the DUT is outputting the proper content.



Press Continue to continue executing the test.

- 11 If the 980 HDMI 1.4 Protocol Analyzer's compliance test application reports PASS, then PASS. If the 980 HDMI 1.4 Protocol Analyzer's compliance test application reports FAIL, then FAIL.

